The Multilin 850 relay is a member of the Multilin 8 Series protective relay platform and has been designed for the management, protection and control of distribution feeder applications. The Multilin 850 is used to provide primary or backup protection for underground and overhead medium voltage feeders from distribution and industrial power networks.

Designed with advanced communications options and detailed asset monitoring capabilities, the Multilin 850 provides advanced functionality, including high-performance protection, extensive programmable logic and flexible configuration capabilities.

Built from a rich history and legacy in providing advanced protection and control solutions and utilizing advanced design practices, superior technology, and state-of-the-art test and manufacturing facilities, GE is raising the bar on system performance, quality and reliability.

Key Benefits
- Increase uptime with industry-leading quality, reliability, and design processes ensuring long operational life
- Reduce downtime with relay environmental diagnostic information
- Simplify testing and increase process uptime with low-insertion force, draw-out construction
- Designed with no electrolytic capacitors and manufactured to IPC-A 610 Class 3 industry standard
- Minimize system configuration time with optional point-to-point Wi-Fi connectivity, allowing secure, local relay programming and diagnostic retrieval

Key Applications
- Oil & Gas / Petrochemical / Refineries
  - Protection and control for feeders and incomers
  - Reliable motor-bus auto transfer and high-speed interlocking schemes
  - Distribution load-shedding schemes
- Mining & Metals
  - Primary or back-up protection for feeders and incomers
  - Reliable, automatic bus transfer schemes
  - High-speed fault detection for arc flash mitigation
- Distribution Utility
  - Protection and control for radial or looped distribution circuits
  - Auto-reclosing control schemes
  - Distribution generation interconnect protection

Exceptional Quality & Reliability
- IPC A-610-E Class 3 manufacturing standards
- Adheres to the highest reliability standards for electronics testing
- 100% Electrical Stress Screening and full functional testing
- Rated for IP54 applications
- Standard Harsh Conformal Coating

Innovative Technology & Design
- Elimination of electrolytic capacitors
- Advanced diagnostics with unique algorithms ensuring asset protection is not compromised
- Single setup and configuration across the platform
- Built-in field swappable power supply
- Enhanced relay draw-out construction
- Advanced and flexible communications offering simplifying system integration
- Embedded communications offering including: IEC® 61850, IEC 62439/PRP, Modbus® RTU & TCP/IP

Uncompromising Service & Support
- Covered under GE’s 10 year warranty plan
- Fully designed, tested and manufactured in at GE facilities
Multilin 850 Overview

The Multilin 850 Feeder Protection System is a protection device designed for the management, protection, and control of distribution feeders. The 850 provides the necessary primary and back-up protection of underground and overhead medium voltage feeders used in industrial and distribution utility applications.

The 850 is an advanced feeder protection relay that provides high-performance protection, high-density I/O, extensive programmable logic and flexible configuration capabilities. With protection and control logic, the 850 allows for simplified coordination with upstream and downstream disconnect devices.

The control features, such as auto transfer schemes, cold load pickup and auto-reclose, available for the optimal protection and control of industrial and distribution networks. This advanced protection relay also offers enhanced features, such as diagnostics, preventative maintenance, condition monitoring, security, and advanced communications options.

The Multilin 850 is designed to solve the unique challenges that customers face in running their day-to-day operations, including maximizing system and process uptime, simplifying system integration and maintenance, and extending the life of critical assets.
Multilin 8 Series Platform - Application Example

From oil pumping and refining facilities, to open pit or underground mining and processing operations, companies demand solutions that ensure maximum process uptime, minimum operational and maintenance efforts, and have the durability to withstand harsh environmental conditions.

The Multilin 8 Series is GE’s next-generation protection and control relay platform designed for industrial and distribution utilities. The platform provides comprehensive protection and asset monitoring for critical feeders, motors, generators, and transformers.

The 8 Series was designed to solve the challenges that customers face in running their day-to-day operations including maximizing system and process uptime, simplifying system integration and maintenance, and extending the life of critical assets. Utilizing advanced design practices (IPC A-610 design standards), superior technology (elimination of all electrolytic capacitors), and state-of-the art test and manufacturing facilities (every device endures 100% Environmental Stress Screening), GE is raising the bar on system performance and reliability.

With advanced communications the 8 Series integrates easily and seamlessly into your new or existing control system, along with your other Multilin protection devices, providing a comprehensive solution for the end-to-end electrical system within your operations.
Exceptional Quality & Reliability

Industry-leading quality, reliability and design processes are at the core of GE’s next generation protective relay platform. With significant investments in state-of-the-art type test facilities that simulate a complete range of operating environments and designed to the IPC A-610 Class 3 standard, adhering to the highest reliability standards and ensuring rugged performance, each device completes one hundred percent Electrical Stress Screening prior to shipping from GE’s facility.

The 850 Feeder Protection System is manufactured in an ISO® 9001:2008 certified manufacturing facility with a completely lead-free design.

Innovative Technology & Design

Available as part of the Multilin 8 Series platform, the Multilin 850 Feeder Protection System provides comprehensive, high-performance protection and control for distribution feeder applications.

For main-tie-main configurations, the Multilin 850 delivers a more economical and reliable solution, enabling customers to reduce hardware requirements and simplify device integration, including safe and secure Wi-Fi communications for system configuration and diagnostics.

Utilizing decades of experience, GE has implemented ease-of-use features, such as configurable scheme logic that eliminates the need for complex end-user programming, driving quicker setup times, decreased implementation costs and reduced points of failure.

The Multilin 850 has an integrated protection integrity engine that utilizes customized algorithms, providing advanced diagnostics to ensure asset protection is not compromised.

Maintaining and safeguarding the electrical supply of an operation is critical to ensuring maximum process availability and performance. The 850 incorporates the latest cyber security features, including password complexity, RADIUS authentication, role-based access control (RBAC), customers to comply with NERC CIP and NISTIR 7628 requirements.

Understanding that customers need protection and control devices that must reliably operate in extremely harsh and challenging environments, GE delivers the Multilin 850 with harsh conformal coating on all printed circuit boards and a patented environmental awareness module that provides real-time detection of environmental factors that affect product life, as part of its standard offering, delivering higher reliability and extended relay life.

Uncompromised Service and Support

Designed, manufactured and tested to the highest standards in the industry at our state-of-the-art facilities, the 850 Feeder Protection System delivers maximum performance for today’s most demanding environments.

In addition to the unparalleled technology and design advancements, to deliver uncompromised performance and reliability, the Multilin 850 Feeder Protection System is also backed by GE’s 10 year warranty plan.

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Field Swappable Power Supply
Extends the usable life of the protection relay and minimizes costly, time consuming replacement and re-configuration.

Harsh Environment Conformal Coating
Standard (not optional) on all printed circuit boards delivering higher reliability and extended relay life

No Electrolytic Capacitors
Increasing quality and reliability for continuous plant operations by removing high failure components

IPC A-610 Class 3 Manufacturing
Drives to the highest level of reliability standards delivering rugged performance

Robust Extruded Aluminum Chassis
Custom-designed extruded aluminum chassis delivering optimal operating performance

Draw-Out
Providing simplified device fleet management
**Full Color Graphical HMI Front Display**

A large, full color Graphic Control Panel (GCP) ensures clear representation of critical status and measurements. When the keypad and display are not being used, the GCP will automatically revert to screen saver mode, which will turn off the display until one of the local pushbuttons is pushed.

The GCP can be used to view device and system status, alarms and event logs, and metering information. The GCP and navigation keys simplify relay configuration and setup, allowing users to make setting changes directly through the front panel.

**LED Indicators for Quick Status Indication**

The front panel includes user configurable LED’s. Each LED can be completely configured and named based on the application and user requirements.

The color of each indicator conveys its importance.

- **G** = Green: General Condition
- **A** = Amber: Alert Condition
- **R** = Red: Serious Alarm or Important Status. The phase OV detection

The 850 front panel provides 14 LED indicators and 3 LED pushbutton indicators. 10 LED’s are user-programmable while “In service” and “Pickup” LED’s are non-programmable. “Trip” and “Alarm” LED’s are not color programmable but can be assigned with selected operands.

User-programmable LED’s can be turned on by a selection of FlexLogic operands representing protection, control or monitoring elements. Each LED can be configured to be self-reset or latched and labeled based on the application and user requirements. User-programmable LED’s can be selected to be either Red, Green or Orange to give the distinctive indication of selected operations.
Robust Security Features
A suite of powerful system security features are designed into the 850, enabling a high level of cyber security protection, helping operators to comply with NERC®/CIP guidelines and regulations. This includes AAA server support (Radius/LDAP), permitting authentication and accounting of all user activities, and RBAC, which provides efficient administration of users and roles within devices.

Advanced Asset Management
By leveraging GE’s global research facilities located around the world, the 850 Feeder Protection Relay has integrated a number of advanced algorithms which allow for detailed diagnostic information to be provided as required. This allows users to make informed decisions based on real operational data.

Environmental Monitoring
The 850 Feeder Protection System implements a patented Environmental Monitoring system that measures and provides operating condition information. The 850 continuously monitors the temperature, humidity, voltage surges and vibration that the relay is exposed to and provides a user the necessary information to make decisions based on the operating environment, enabling proactive decisions prior to any system issues that may arise. In addition, the 850 performs comprehensive device health diagnostic tests at startup and continuously during run-time to test its own major functions and critical hardware.

Built into the relay as a standard feature, the 850 includes high-accuracy metering and recording for all AC permitting, current, voltage, and power metering. Current and voltage parameters are available as total RMS magnitude, and as fundamental frequency magnitude and angle. The 850 also measures up to the 25th harmonic and total harmonic distortion (THD) on voltage and current, suitable for power quality applications.

Monitoring system performance with oscillography and event records.

Designed for Ease-of-Use
Continuing its legacy in providing easy-to-use protective relay solutions, the 850 is designed to minimize product and system configurability requirements, for quicker physical installations, easier and simplified setup and configuration.
Simplified Setup and On-Going Maintenance

The robust 850 streamlines user workflow processes and simplifies engineering tasks, such as configuration, wiring, testing, commissioning, and maintenance. Building on the history of simplified setup and configuration, the 850 Feeder Protection Relay has implemented simplified setup screens to assist in minimizing relay setup time. In addition, for local programming, the 850 comes with a fully functional GCP, which allows users to locally monitor the asset.

1. Easy to Use - Draw-out case
2. Easy to Configure - 1 simple step
3. Detailed Diagnostics

Software and Configuration

The EnerVista™ suite is an industry-leading set of software programs that simplifies every aspect of using the Multilin 850. EnerVista provides all the tools to monitor the status of the protected asset, maintain the device and integrate the information measured by the Multilin 8 Series, into SCADA or DCS process control systems. The ability to easily view sequence of events is an integral part of the setup software, as postmortem event analysis is critical to proper system management.

EnerVista Launchpad

The setup tools within Launchpad allow for the configuration of devices in real-time, by communicating via serial, Ethernet or modem connections, or offline, by creating device setting files to be sent to devices at a later time.

8 Series Setup Software

EnerVista setup software can reduce device setup and configuration time.
**Extensive Communications Options**

The 850 provides advanced communications technologies for remote data and engineering access, making it easy and flexible to use and integrate into new and existing infrastructures. Direct support for fiber optic Ethernet provides high-bandwidth communications, allowing for low-latency controls and high-speed file transfers of relay fault and event record information. The 850 also supports two independent IP addresses, providing high flexibility for the most challenging of communication networks.

Providing several Ethernet and serial port options and supporting the widest range of industry standard protocols, the 850 enables easy, direct integration into DCS and SCADA systems. The 850 supports the following protocols:

- IEC 61850, IEC 62439 / PRP
- DNP 3.0, IEC 60870-5-103, IEC 60870-5-104
- Modbus RTU, Modbus TCP/IP

**Designed to Support Multiple Applications**

Industrial and distribution utility electrical systems have become more complex, requiring protection relays to deliver faster detection and operation, while providing instantaneous, remote access to critical asset information. In addition, as conditions and power requirements change within the facility, the protection device must be able to seamlessly adapt to and integrate within the network. With a suite of intelligent devices that range from feeder to motor to transformer and generator protection, the Multilin 8 Series platform has been designed to solve the challenges industries face in running their day-to-day operations, including maximizing system and process uptime, simplifying system integration and ongoing maintenance, and extending the life of critical assets.

GE’s 850 Feeder Protection Relay can be used to support numerous applications and functions, including feeder protection, bus blocking/interlocking schemes, auto transfer schemes, load shedding applications, auto-reclose applications, customer-utility interconnections, and distributed generation applications. The 850 incorporates advanced automation features, including powerful programmable logic, communications, and SCADA capabilities, that allow for advanced and flexible programming, and easy integration into new and existing communication architectures. In addition, the 850 integrates seamlessly with other GE Multilin relays for complete system protection.

**Application Challenge: Intelligent Load Shedding**

**Challenge:**
In a multiple power source network, it may happen that some power sources are lost utility circuit creating deficit of the power even with a presence of in-facility generator. In these partially islanding situations the deficit of active power may result in a sudden drop of system frequency resulting in power system instability, bring the processes and operations to a halt.

**Solution:**
Being able to dynamically balance and maintain loads in this type of separation scenario requires an intelligent device that has advanced communications, automation and control logic capabilities. The Multilin 850 provides distribution networks and industrial facilities with the system stability functionality and cost saving options, required to maintain power system availability and process continuity. With and advanced protection features including underfrequency, overfrequency, frequency rate of change, sensitive reverse power, underfrequency restoration and other elements plus superior communications enabling sharing data with other IEDs, distribution utilities and industrial facilities rely on GE 850 to deliver power system reliability, efficiency and security required.

**Application Challenge: Modern Feeder Protection**

**Challenge:**
Industrial facilities depend on reliable and secure electricity services to keep their operations running. Regardless if the facility is supplied directly from a utility source and/or supported by on-site generation (co-generation), a fully integrated protection & control scheme is critical to maintaining uninterrupted power to the entire facility.

**Solution:**
The Multilin 8 Series offers the ideal solution for protecting, monitoring and controlling electrical cables and overhead lines from disturbances or faults. With a fast protection pass, running every 2 msec, the 8 Series provides unmatched overcurrent, overvoltage, undervoltage, and frequency protection. Supporting the latest in industry standard communication protocols, including IEC 62439/PRP and IEC 61850, the Multilin 8 Series easily integrates into new or existing networks.
Technical Application Example 1: Industrial Auto Transfer Schemes

Challenge
Bus or source transfer solutions are often necessary for industrial facilities to ensure power reliability and process continuity. Being able to rapidly transfer sources was often accomplished through a complex combination of discrete and auxiliary relays, timers, and/or programmable logic controllers, all wired together. The usage of these independent devices required a precise sequencing of interlocks, timing, and functions to ensure no momentary loss of power could potentially damage critical equipment or loads. In addition, the large number of physical I/O required made these schemes expensive to design and implement and difficult to test.

Solution
The Multilin 850 offers seamless automated bus transfer scheme solutions, maximizing system availability and process uptime. Using a minimal amount of programming, the 850 eliminates the need for any discrete devices and device inter-wiring by integrating all the functions directly into the intelligent device. With advanced communications including embedded support for IEC 61850 peer-to-peer communications, inter-relay wiring and physical I/O can be eliminated. The 850 provides a reliable, automatic bus transfer solution that is easy to design, configure, and maintain.

Technical Application Example 2: Zone Selective Interlocking

Challenge
A Fault in an industrial or utility distribution system is a catastrophic event that causes severe damage to equipment and often results in extended system and process downtime. These events require a solution that can quickly and reliably detect and issue a coordinated trip command to clear the fault as fast as possible, reducing total incident energy, equipment damage and system downtime.

Solution
With embedded support for IEC 61850, the 850 provides high-speed data exchange between relays for fast reaction to system issues. As a coordinated system, interlocked protection can be enabled, to provide the necessary bus protection. Fast clearance can be achieved for a fault that occurs at any feeder or bus location by quickly exchanging signals to discriminate the fault location.
Technical Application Example 3: Intelligent Auto-Reclose

Challenge
A majority of faults that occur on overhead lines are transient in nature, meaning that the fault does not recur when the line is re-energized after tripping. However, in the event the fault is still present after the 1st reclose attempt, there is a good possibility that next reclose attempts will be successful and power supply to the customer will be restored. Therefore, in order to maintain system availability and security, utility operators need an intelligent auto-reclose solution that allows them to automatically attempt to re-energize a line multiple times, depending on the system conditions and user requirements. Today’s environment requires integrated solutions into digital relays.

In a modern distribution feeder topology, substation relay auto-reclose functions should maintain coordination with downstream reclosures installed along the feeder.

Solution
For customers wanting a reliable and customized auto-reclose scheme, a device with integrated logic capabilities is necessary. The 850 offers comprehensive protection and auto-reclose functions integrated in one box.

Up to four auto-reclose operations are possible, each with a programmable dead time. For each reclose shot, the relay can be programmed to block IOC elements, and to adjust the curve characteristics of any TOC element.

The number of shots can be reduced by high currents. Maximum rate per hour reclose shots would prevent breaker drive and insulation overstressing.

850 relay can be programmed to change protection setting every time the downstream reclosure operates and also maintain same reclosure count as downstream reclosure.

Technical Application Example 4: Adaptive Protection

Challenge:
To effectively manage an electrical distribution system, operators need the ability and flexibility to change power output on a seasonally or even hourly basis due to scheduled maintenance, seasonal load changes and transfers, scheduled switching, transformer inrush or motor starting currents. These distribution changes could have an adverse effect on the reliability of the system and connected loads and requires a protection device that can adapt to ensure secure and dependable protection.

One such application where dynamic setting group change ability is ideal, is with a parallel feeder application where two lines are in service and carry a portion of the required load. If there is an unplanned outage with one of the feeder lines, such that all loads are now supplied by one feeder, key protection settings would need to be adjusted to ensure proper coordination with downstream devices and deliver secure reliable service.

Solution:
The Multilin 850 offers effective, reliable management of distribution feeders. With dynamic, sensitive settings, the 850 provides secure and dependable protection. With six setting groups the 850 provides the sensitive settings range and groups required to ensure no compromise is made to meet changing system conditions. These setting groups can be enabled automatically or manually to address system needs, ensuring greater system reliability and efficiency.
Functional Block Diagram

Dimensions & Mounting

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### Technical Specifications

#### POWER SUPPLY

**Power Supply**
- **Nominal DC Voltage**: 125 to 250 V
- **Minimum DC Voltage**: 84 V
- **Maximum DC Voltage**: 300 V
- **Nominal AC Voltage**: 100 to 240 V at 50/60 Hz
- **Minimum AC Voltage**: 60 V at 50/60 Hz
- **Maximum AC Voltage**: 265 V at 50 to 60 Hz

**Voltage loss ride through**
- **Maximum 18 W/ 56VA**

**Voltage**
- **Maximum DC Voltage**: 84 V
- **Nominal AC Voltage**: 100 to 240 V at 50/60 Hz
- **Minimum DC Voltage**: 84 V

**Continuous current**: 10 A

**Operate time**: <8 ms

**Contact material**: silver-alloy

**Configuration**: electromechanical

**Trickle current**: 1 to 2.5 mA

**Applicable voltage**: 20 to 300 VDC

**Continuous current**: 10 A

**Maximum W/ 56VA**: 18 W

**INPUTS**

**AC Currents**
- **CT Rated Primary**: 1 to 12000 A
- **CT Rated Secondary**: 1 A or 5 A based on relay ordering
- **Nominal Frequency**: 50 and 60 Hz

**Burden**: < 0.2 VA at rated secondary

**Conversion Range**: Standard CT: 0.02 to 46 x CT rating RMS symmetrical

**CT Accuracy**: Sensitive Ground CT module: 0.002 to 46 x CT rating RMS symmetrical

**Short Term CT Withstand**: 1 second at 100 x rated current, 2 seconds at 40 x rated current, continuous at 3 x rated current

**AC Voltage**
- **VT Range**: 10 to 260 V
- **VT Accuracy**: ±0.5% of reading from 10 to 240 V
- **Nominal Frequency**: 20 to 65 Hz
- **Burden**: <0.25 VA at 120 V
- **Conversion Range**: 1 to 275 V

**Voltage Withstand**: Continuous at 260 V to neutral 1 min/ hr at 420 V to neutral

**OUTPUTS**

**Form-A Relays**
- **Configuration**: 2 (twol electromechanical

**Contact material**: silver-alloy

**Operate time**: <8 ms

**Continuous current**: 10 A

**Make and carry**: 30 A per ANSI C37.90

**Break (IC, inductive)**
- **24 V / 1 A 48 V / 0.5 A 125 V / 0.3 A
- **24 V / 1 A 48 V / 0.5 A 125 V / 0.3 A
- **24 V / 1 A 48 V / 0.5 A 125 V / 0.3 A

**Break (AC, inductive)**
- **24 V / 1 A 48 V / 0.5 A 125 V / 0.3 A

**Break (DC, inductive)**
- **24 V / 1 A 48 V / 0.5 A 125 V / 0.3 A

**Form-A Voltage Monitor**
- **Applicable voltage**: 20 to 300 VDC

**Tirckle current**: 1.25 to 2.5 mA

**Form-C Relays**
- **Configuration**: electromechanical

**Contact material**: silver-alloy

**Operate time**: <8 ms

**Continuous current**: 10 A

**Make and carry**: 30 A per ANSI C37.90

**Break (IC, inductive, LR=40 ms)**
- **24 V / 1 A 48 V / 0.5 A 125 V / 0.3 A

### Phase Undervoltage (27P)

**Voltage**: Fundamental Phasor Magnitude

**Minimum Voltage**: 0.00 to 1.50 x VT in steps of 0.01 x VT

**Pickup Level**: 0.00 to 1.50 x VT in steps of 0.01 x VT

**Dropout Level**: 102 to 103% of pickup

**Level accuracy**: ±0.5% of reading from 10 to 208 V

**Phases Required for Operation**: Any one, Any two, All three

**Undervoltage Curves**: Definite Time or Inverse Time

**Pickup Time Delay**: 0.000 to 6000.00 s in steps of 0.001 s

**Operate Time**: <16 ms at 0.90 x pickup from 1.1 x pickup at 60 Hz < 20 ms at 0.90 x pickup from 1.1 x pickup at 50 Hz

**Curve Timing Accuracy**: at < 0.90 x pickup ± 3.5% of curve delay or ± 1 cycle whichever is greater from pickup to operate

### Phase Overvoltage (58P)

**Voltage**: Fundamental Phasor Magnitude

**Pickup Level**: 0.02 to 3.00 x VT in steps of 0.01 x VT

**Dropout Level**: 97 to 98% of Pickup

**Level accuracy**: ±0.5% of reading from 10 to 208 V

**Phases for operation**: Any one, Any two, All three

**Pickup time delay**: 0.000 to 6000.00 s in steps of 0.001 s (definite time)

**Dropout time delay**: 0.000 to 6000.00 s in steps of 0.001 s (definite time)

**Operate time**: < 25 ms at 1.3 x pickup at 60Hz < 30 ms at 1.1 x pickup at 50Hz

**Timer accuracy**: ± a 3% delay setting or ± 1/4 cycle ( whichever is greater) from pickup to operate

### Overfrequency (810)

**Pickup Level**: 0.00 to 65.00 Hz in steps of 0.01

**Dropout Level**: Pickup + 0.03 Hz

**Pickup Time Delay**: 0.000 to 6000.00 s in steps of 0.001 s

**Dropout Time Delay**: 0.000 to 6000.00 s in steps of 0.001 s

**Minimum Operating Voltage**: 0.000 to 1.250 x VT in steps of 0.001 s

**Level Accuracy**: ± 0.01 Hz

**Timer Accuracy**: ± a 3% of delay setting or ± 1/4 cycle ( whichever is greater) from pickup to operate

**Operate Time**: typically 4 cycles at 0.1 Hz change typically 3.5 cycles at 0.3 Hz change typically 3 cycles at 0.5 Hz change

### Underfrequency (811)

**Pickup level**: 20.00 to 65.00 Hz in steps of 0.01

**Dropout level**: Pickup + 0.03 Hz

**Pickup time delay**: 0.000 to 6000.00 s in steps of 0.001 s

**Dropout time delay**: 0.000 to 6000.00 s in steps of 0.001 s

**Minimum operating voltage**: 0.000 to 1.250 x VT in steps of 0.001 s

**Minimum operating current**: 0.000 to 3000 x CT in steps of 0.001 x CT

**Level accuracy**: ± 0.01 Hz

**Timer accuracy**: ± a 3% of delay setting or ± 1/4 cycle ( whichever is greater) from pickup to operate

**Operate time**: typically 4 cycles at 0.1 Hz change typically 3.5 cycles at 0.3 Hz change typically 3 cycles at 0.5 Hz change

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Multilin 850 - Feeder Protection System
Multilin 850 - Feeder Protection System

**Frequency Rate Of Change (81R)**

- **df/dt trend:** Increasing, Decreasing, Bi-directional
- **df/dt pickup level:** 0.10 to 15.00 Hz/s in steps of 0.01
- **df/dt dropout level:** 96% of Pickup Level
- **df/dt level accuracy:** ±0.02
- **Timer accuracy:** ±3% of delay setting or a ¼ cycle (whichever is greater) from pickup to operate

**Synchrocheck (25)**

- **Maximum Frequency Difference:** 0.01 to 5.00 Hz in steps of 0.01 Hz for frequency window of from ± 5 Hz
- **Maximum Angle Difference:** 0° to 100° in steps of 1°
- **Hysteresis for Maximum Frequency Difference:** 10 to 600000 V in steps of 1 V
- **Accuracy:** ±0.2° + 1.8e-5*(f/60)^2.7 of reading, where f is the harmonic frequency

**Synchrocheck (25)**

- **Parameter:** 1a, 1b, 1c, 2a, 2b, 2c, 3a, 3b, 3c
- **Magnitude Accuracy:** ±1.0% of reading or 0.1 kVA
- **Phase Accuracy:** ±3°

**Digital Counters**

- **Number of Counters:** 16
- **Accuracy:** ±0.02 of reading or ±0.2% of rated whichever is greater from pickup to operate
- **Operating Time:** <24 cycles
- **Number of Polaxes:** 3
- **Reclose attempts:** Up to 6

**Demand**

- **Measured Values:** Phase A/B/C present and maximum current, three-phase present and maximum real/reactive/apparent power
- **Accuracy:** ±0.02
- **Measurement Type:** Thermal Exponential, 90% response time (programmed: 5, 10, 15, 20, 30, or 60 min)
- **Block Interval:** Rolling Demand, time interval (programmed: 5, 10, 15, 20, 30, or 60 min)

**Reactive Power (Vars)**

- **Parameters:** 3-phase; per phase if VT is Wye
- **Magnitude Accuracy:** ±0.5% of reading or ±0.2% of rated whichever is greater from pickup to operate

**Phasors**

- **Parameters:** Phase A, B, C, Neutral, Ground and Sensitive Ground
- **Accuracy:** ±0.5% of reading from 10 to 208 V

**Transient Recorder**

- **Default AC Channels:** 5 currents + 4 voltages
- **Sampling Rate:** 128 /c to 64/c or 32/c to 16/c
- **Trigger Source:** Any element pickup, dropout or operate, digital input or output change of state, FlexLogic operand
- **Storage Capability:** non-volatile memory

**Real Power (Watts)**

- **Parameters:** Wye VTs: A-B, B-S, C-B, B-S, C-C, A-S
- **Accuracy:** ±0.2% of reading or ±0.02 of rated whichever is greater from pickup to operate

**Voltage**

- **Parameters:** Wye VTs: A-n, B-n, C-n, A-B, B-C, C-A, Average Phase, Neutral and Residual
- **Delta VTs: A-B, B-C, C-A, Neutral and Residual
- **Accuracy:** ±0.02

**Apparent Power (VA)**

- **Parameters:** Wye VTs: A-B, B-C, C-A, Average Phase, Neutral and Residual
- **Delta VTs: A-B, B-C, C-A, Neutral and Residual
- **Accuracy:** ±0.02
### Var-hours (positive and negative)
- **Range:** -2147483647 MVarh to 2147483647 MVarh
- **Parameters:** 3-phase only
- **Update Rate:** 50 ms
- **Accuracy:** ± 2.0% of reading

### Ethernet – Base Offering
- **Modes:** 10/100 Mbps
- **One Port:** RJ45
- **Protocol:** Modbus TCP

### Ethernet – Card Option
- **Modes:** 100 MB
- **Two Ports:** ST (with this option both enabled ports are on the communications card; the Ethernet port located on the base CPU is disabled)
- **Protocols:** Modbus TCP, DNP3.0, IEC60870-5-104, IEC 61850 GOOSE, IEEE 1588, SNTP, IEC 62439-3 clause 4 (PRP)

### USB
- **Standard:** Compliant with USB 2.0
- **Data transfer rate:** 10 MB

### Testing and Certification

<table>
<thead>
<tr>
<th>Test</th>
<th>Reference Standard</th>
<th>Test Level</th>
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<tr>
<td>Dielectric voltage withstand</td>
<td>EN60255-5</td>
<td>2.3 kV</td>
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<tr>
<td>Impulse voltage withstand</td>
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### Approvals

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### Environmental

- **Ambient temperatures:**
  - Storage/Shipping: -40C to 85C
  - Operating: -40C to 60C
- **Humidity:** Operating up to 95% (non-condensing) @ 55C. AS per IEC60068-2-30 Variant 2, 6days
- **Altitude:** 2000m (max)
- **Pollution Degree:** II
- **Overvoltage Category:** III
- **Ingress Protection:** IP54 Front, IP10 back

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# Ordering

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Markham, ON  
Canada L6C 0M1  
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